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(54) TDMA systems

(57) A method of minimising interference caused by digital Time Division Multiple Access (TDMA) transmitting systems comprises the steps of: transmitting a burst of speech data at a particular power level on one time slot of a plurality of time slots of a TDMA frame on a particular frequency channel, the traffic channel; and transmitting a radio carrier at substantially the same power level as the speech data during a gap in the time slots on the traffic channel at a different frequency level to that of the traffic channel, thereby filling in the gaps in the traffic channel such that a continuous signal is transmitted.

Fig. 1a

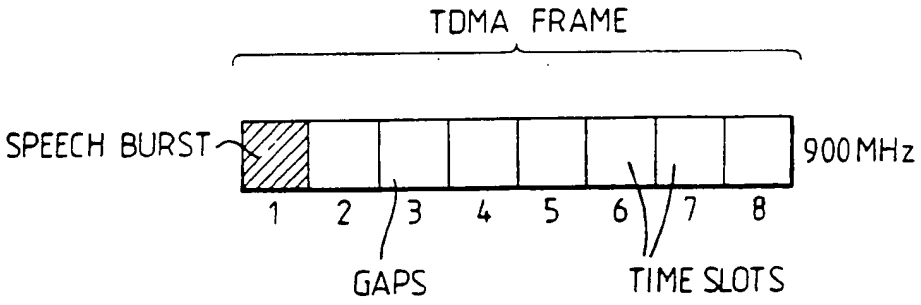
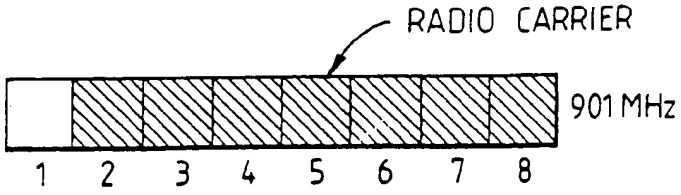


Fig. 1b



At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

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Fig. 1a

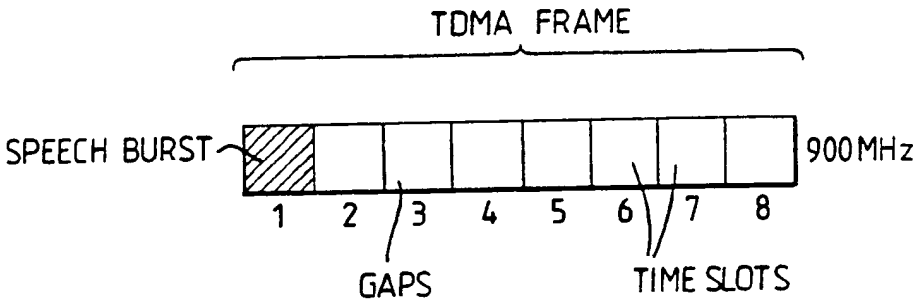
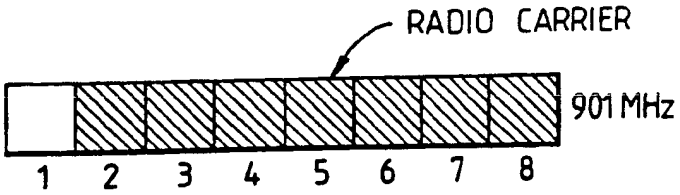


Fig. 1b



Improvements in or relating to TDMA Systems

This invention relates to improvements in or relating to Time Division Multiple Access, or TDMA, systems.

Up until recently communication systems operated using analogue transmission. However, modern systems are now moving towards digital transmission, an example of which is the portable cordless telephone, which operates on low power ie, 10mW maximum. Also more modern communication systems are now being proposed which use both digital transmission and Time Division Multiple Access (TDMA) techniques. It is expected that systems offering the user portability and mobility will proliferate. An example of such a system is the Groupe Special Mobile (GSM) system. GSM was set up to formulate the specifications for a Pan European mobile cellular radio system. Other modern systems include CT2 cordless telephones and Digital European Cordless Telephones (DECT). The new systems are planned to transmit at much higher power levels than previous systems - for example hard portable telephones will be transmitting at between 2W and 5W and car telephones at 8W, compared to about 10mW for previous systems. Some telephones may even transmit at as high as 20W. Transmitting at such high power levels causes problems when coupled with TDMA techniques.

The nature of such systems is that a mobile unit transmits a burst of speech data for a defined period - or timeslot. This is followed by a gap, which in turn is followed by successive bursts of speech data and gaps which constitutes an unintended amplitude modulated carrier with a modulation index of 1.0. If the bursts are transmitted at sufficiently high field strengths, this can be detected by a non-linear circuit element in domestic electronic equipments including radios, personal stereos, and hearing aids. At certain burst rates, the consumer electronic equipment will cause audio components to be generated which will be heard as interference.

There is therefore a need for a way of eliminating the interference heard in domestic electronic equipment caused by modern communication systems operating at high power level using TDMA techniques.

According to the present invention there is a method of minimising interference suffered by domestic electronic equipment caused by digital TDMA transmitting systems comprising the steps of: transmitting a burst of speech data at a particular power level on one time slot of a plurality of time slots of a TDMA frame on a particular frequency channel, the traffic channel; transmitting a radio carrier at substantially the same power level during a gap in the time slots on the traffic channel at a different frequency level to that of the traffic channel; thereby filling in the gaps in the traffic channel such that a continuous signal is transmitted.

The consumer electronic equipment will thus detect a constant transmission power envelope which when demodulated in the equipment appears as a continuous dc level. This can be simply filtered out using standard methods. By use of this method, any audio components are either not generated, causing any interference to be eliminated or are reduced with some of the residual energy shifted above the audio hearing range.

The TDMA frame typically comprises eight time slots and the frequency band used is in the region of 900 MHz.

Examples of TDMA transmitting systems likely to cause interference with domestic equipment include GSM digital cellular radio, CT2 cordless telephones, and Digital European Cordless Telephones (DECT). In addition, the base stations associated with these systems are also likely to cause interference so this method is equally applicable to base stations.

Domestic electronic equipment that may be affected includes radios, personal stereos and hearing aids.

The present invention will now be described, by way of example only, with reference to the accompanying drawing in which

Figs 1a and 1b are diagrammatic representations of a single TDMA frame.

Considering a hand portable telephone (not shown) transmitting at 2W at a frequency of 900 MHz the telephone will transmit bursts of speech data which, as shown in Fig 1a occupies time slot 1 of the TDMA frame at 900 MHz. This is called the traffic channel. The

other time slots may be empty or contain data from other mobile telephones etc. Thus gaps in the transmission are set up, which will cause audible interference when picked up by non-linear circuit elements in domestic electronic equipment. In order to eliminate the gap a radio carrier is transmitted on another frequency channel, say 901 MHz, during the gaps on the traffic channel, at substantially the same power level as the data transmitting on the traffic channel.

A continuous transmission is thus provided which, when demodulated in domestic electronic equipment, appears as a continuous dc level which can be simply filtered out using standard methods.

The choice of which other frequency channels to use to carry the spare timeslot speech data is a choice between filter complexity/ cost, and acceptable levels of subjective interference. However, by organising the system so that the same channel or frequency is used for this gap-filling, the loss of system capacity is minimised. Further, the system is so organised that this gap filling transmission only takes place for higher powered transmissions from mobiles. In this way, battery consumption for lower mobile equipment would not be affected.

It will be realised that this method will be equally applicable to the base stations which also operate at high power levels and will cause similar interference problems as those caused by digital cellular radio and cordless telephones.

The system is also designed such that the method herein described will only come into effect if power levels on the traffic channel are likely to lead to harmful interference effects.

CLAIMS

1. A method of minimizing interference suffered by domestic electronic equipment caused by digital Time Division Multiple Access (TDMA) transmitting systems comprising the steps of:

transmitting a burst of speech data at a particular power level on one time slot of a plurality of time slots of a TDMA frame on a particular frequency channel, the traffic channel;

transmitting a radio carrier at substantially the same power level as the speech data during a gap in the time slots on the traffic channel at a different frequency level to that of the traffic channel;

thereby filling in the taps in the traffic channel such that a continuous signal is transmitted.

2. A method as claimed in Claim 1 wherein the continuous signal is picked up by a non-linear circuit element in the domestic electronic equipment, demodulated to a continuous dc signal and filtered out.

3. A method as claimed in claims 1 or 2 wherein the TDMA comprises eight time slots.

4. A method as claimed in any of claims 1 to 3 wherein the frequency of transmitted data is in a 900 MHz band.

5. A method as claimed in any previous claim wherein the TDMA transmitting system is a GSM cellular radio.

6. A method as claimed in claims 1 to 4 wherein the TDMA transmitting system is a cordless telephone.

7. A method as claimed in claims 1 to 4 wherein the TDMA transmitting system is a base station.

8. A method as claimed in any previous claim wherein a radio carrier is transmitted only when power levels on the traffic channel are likely to lead to harmful effects.

9. A method substantially as herein described with reference to the accompanying drawing.

10. Apparatus for carrying out the method as claims in any one of claims 1 to 9.

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